PHYTOTOXICOLOGY VEGETATION ASSESSMENT SURVEY: CANADA BRICK, BURLINGTON (1993)

JULY 1994

Ontario

Ministry of Environment and Energy

ISBN 0-7778-2929-0

PHYTOTOXICOLOGY VEGETATION ASSESSMENT SURVEY:

CANADA BRICK, BURLINGTON

(1993)

JULY 1994

Cette publication technique
n'est disponible qu'en anglais.

PIBS 3197

PHYTOTOXICOLOGY VEGETATION ASSESSMENT SURVEY:

CANADA BRICK, BURLINGTON

(1993)

Report prepared by:

R. Emerson
Standards Development Branch
Phytotoxicology Section
Ontario Ministry of Environment and Energy

Report No: SDB-034-3512-94

Abstract:

In 1993, concentrations of fluoride in tree foliage in the area of Canada Brick, Burlington, generally increased over 1992. Injury to vegetation was not markedly different from 1992, with the most severe injury, as in previous years, being confined to the immediate area of the company. Weather conditions could have contributed to at least some of the increase in vegetation fluoride concentrations in 1993. Canada Brick is still a significant but very localized fluoride emission source.

Phytotoxicology Vegetation Assessment Survey:
Canada Brick, Burlington(1993)

Introduction

In 1993, the MOEE Central Region (Halton-Peel District office) requested a Phytotoxicology assessment survey in the vicinity of Canada Brick (CB), Burlington, to determine the effects of fluoride emissions on surrounding vegetation. Vegetation surveys in the vicinity of this brickwork have been conducted regularly since 1986. CB expanded its brick production facility in late 1986 through mid-1987. This report presents the results of the most recent 1993 survey, which was conducted by R. Emerson, Phytotoxicology Specialist, on August 30, 1993. The 1986 through 1992 survey results have been previously reported.

The east and north boundaries of CB lie adjacent to the Bronte Creek valley. The west boundary borders CNR tracks and is neighboured to the immediate west by scrub land and commercial/industrial properties. Neighbouring the southern boundary were commercial and residential properties abutting on Dundas St. (see attached map).

Investigation Procedures

In 1993, tree foliage sampling on company property was reduced from three sites (Sites 1, 2, 3) to a single site (Site 3). Trees at Sites 5 and 8, that were in generally poor condition with declining branches, also were not sampled in 1993. Control Site 14 was discontinued because sugar maple foliage was not sampled in the area of CB in 1993.

At the remaining previously established stations (3, 4, 6, 7, 12, 15, 16, 9, 11), duplicate foliage samples were collected from exposed middle branches using standard procedures. These sites, with exception of Sites 7 and 16 (to west of CB), were situated on or near residential properties (see map). In addition, tree foliage and other vegetation in the vicinity of the collection sites was inspected for fluoride injury.

The foliage samples were returned to the Phytotoxicology laboratory, where they were processed on an "unwashed" basis (oven-dried, ground and stored in glass jars). They were then submitted to the MOEE Laboratory Services Branch for fluoride analysis.

Investigation Findings

Results of Foliar Inspections

Similar to previous years, wild grape was the species most severely and extensively injured in the survey area. In 1993, the most severe injury was observed immediately east and west of CB in the vicinity of former Site 1 and Sites 3, 4, 7 and 16. Wild grape plants in these areas had foliage with light (2-10%) to moderate (11-35%) injury, but light injury overall. In the area of Site 1 (company property), a few wild grape leaves also had severe injury (>35%). Wild grape plants elsewhere had either trace or trace to light injury overall. The severity of injury observed on wild grape plants in the survey area in 1993 was not markedly different from that observed in 1992.

Silver maple Sites 3 and 12 had some leaves with trace injury (blackish tip necrosis) symptomatic of fluoride. Nearby Manitoba maple Sites 4 and 6 also had fluoride-like foliar injury. However, as these trees had boxelder borer damage, which can result in foliar injury mimicking fluoride toxicity, Manitoba maples are not considered to be reliable indicators of fluoride exposure.

The foliar inspections in 1993 also revealed trace injury typical of fluoride on gladiolus plants on the residential property immediately west of former Site 5. Other vegetation inspected in the survey area, including Eastern white pine and scots pine, did not display fluoride-like injury.

Analytical Results

Table 1 shows the "unwashed foliage" fluoride concentrations encountered from 1986 to 1993 in ug/g (commonly referred to as ppm or parts per million). Similar to previous surveys, foliar concentrations of fluoride were highest at sites close to CB and decreased with increasing distance from CB.

In 1993, the foliage collected at Site 12 (160 ug/g) contained the highest fluoride concentration followed by Site 3 (155 ug/g). These sites were situated southeast of CB and were adjacent to residential properties abutting Dundas Street. In previous years, the highest level usually occurred at Site 7 to the immediate west southwest of CB. Compared to 1992, foliar fluoride concentrations increased at most sites, except Sites 7 and 16 (west of CB). At these sites, foliar fluoride levels were amongst the lowest detected. In contrast, fluoride concentrations at Site 12 (160 ug/g) and Site 6 (80 ug/g) were the highest detected at these stations since 1986. The level at Site 12 was about 3 times the 1992 level (56 ug/g), but was only marginally higher than in 1989 (120 ug/g). The mean for all common sites also was marginally higher in 1993 (96 ug/g) than in 1992 (73 ug/g). Since 1986, the mean for the common sites has ranged from a low of 54 ug/g (1986) to a high of 124 ug/g (1987).

In 1993, all sites, except Sites 9 and 16, had a foliar fluoride concentration greater

than the Phytotoxicology Section rural Upper Limit of Normal guideline of 15 ug/g (see appendix). The two highest foliar levels of 160 ug/g (Site 12) and 155 ug/g (Site 3) were about 10 times the rural ULN.

Weather Data and Discussion

The wind and rainfall data obtained from the closest weather stations (Oakville, Pearson Airport) for June through August are summarized in Table 2 (wind) and Table 3 (rain). In 1993, the Oakville station revealed a 7% increase in west and west northwest winds (21.7%) compared to 1992 (14.7%). Within limits, rain can remove fluoride, especially of the particulate type, by its washing action. This action can be reflected in the analytical results, wherein years with high rainfall should have lower fluoride concentrations if other factors are held constant. Conversely, dry years should be associated with higher fluoride levels. The rain data for the Pearson International Airport (Table 3) shows that, in relation to 1992, there were fewer days with rain and less rainfall overall in 1993, particularly in July and August, with the amount of rain in August (38.7 mm) being well below normal (82.1 mm). The preceding data suggests that the increase in vegetation fluoride levels in 1993 could have been due, at least in part, to weather conditions.

Summary

The 1993 vegetation survey around Canada Brick, Burlington, revealed that foliar concentrations of fluoride generally were increased in 1993 over 1992. Injury to sensitive vegetation (e.g. wild grape) was not markedly different from 1992, with the most adverse effects, as in previous years, being confined to the immediate area of the company. Weather conditions could have contributed to the increase in vegetation fluoride concentrations in 1993. Canada Brick remains a significant but localized fluoride source.

Table 1: Analytical Results: Canada Brick, Burlington (1993)									
Site No.	Location**	Foliage Type	Fluoride Concentration* in Unwashed Maple Foliage						
			1986	1987	1989	1990	1991	1992	1993
Sites Neighbouring Canada Brick									
3	400 m ESE	Silver maple	*70*	*229*	*160*	*248*	*140*	*99*	*155*
4	550 m ESE	Manitoba maple	*33*	*69*	*64*	*66*	*61*	*48*	*59*
6	540 m SE	Manitoba maple	*20*	*58*	*68*	*50*	*71*	*50*	*80*
7	125 m WSW	Apple	*160*	*269*	*290*	*63*	*285*	*165*	*100*
12	530 m SE	Silver maple	*15*	*89*	*120*	*70*	*86*	*56*	*160*
15	700 m E	Manitoba maple	*23*	*32*	*26*	*53*	*20*	*20*	*23*
16	380 m WNW	Silver maple	*NR*	*NR*	*NR*	*20*	*45*	*21*	*12*
Mean of Common Sites* **			***54***	***124***	***121***	***92***	***111***	***73***	***96***
Sites More Distant from Canada Brick									
9	960 m SSW	Manitoba maple	*8*	*9*	*9*	*7*	*9*	*9*	*9*
		Silver maple	*NR*	*NR*	*NR*	*11*	*10*	*NR*	*9*
11	960 m SE	Silver maple	*12*	*12*	*26*	*13*	*31*	*13*	*22*
Rural ULN			***15***						

* ug/g dry weight, mean of duplicate samples and analysis, except in 1990 at Sites 3, 5, 6 and 12 (4 samples/site).
** Approximate distance (meters) and direction from Canada Brick.
*** Common sites excluding Site 16.
ULN - Phytotoxicology Section Upper limit of Normal rural guideline, see appendix. Shaded values exceed ULN.
NR - No result, samples not collected.

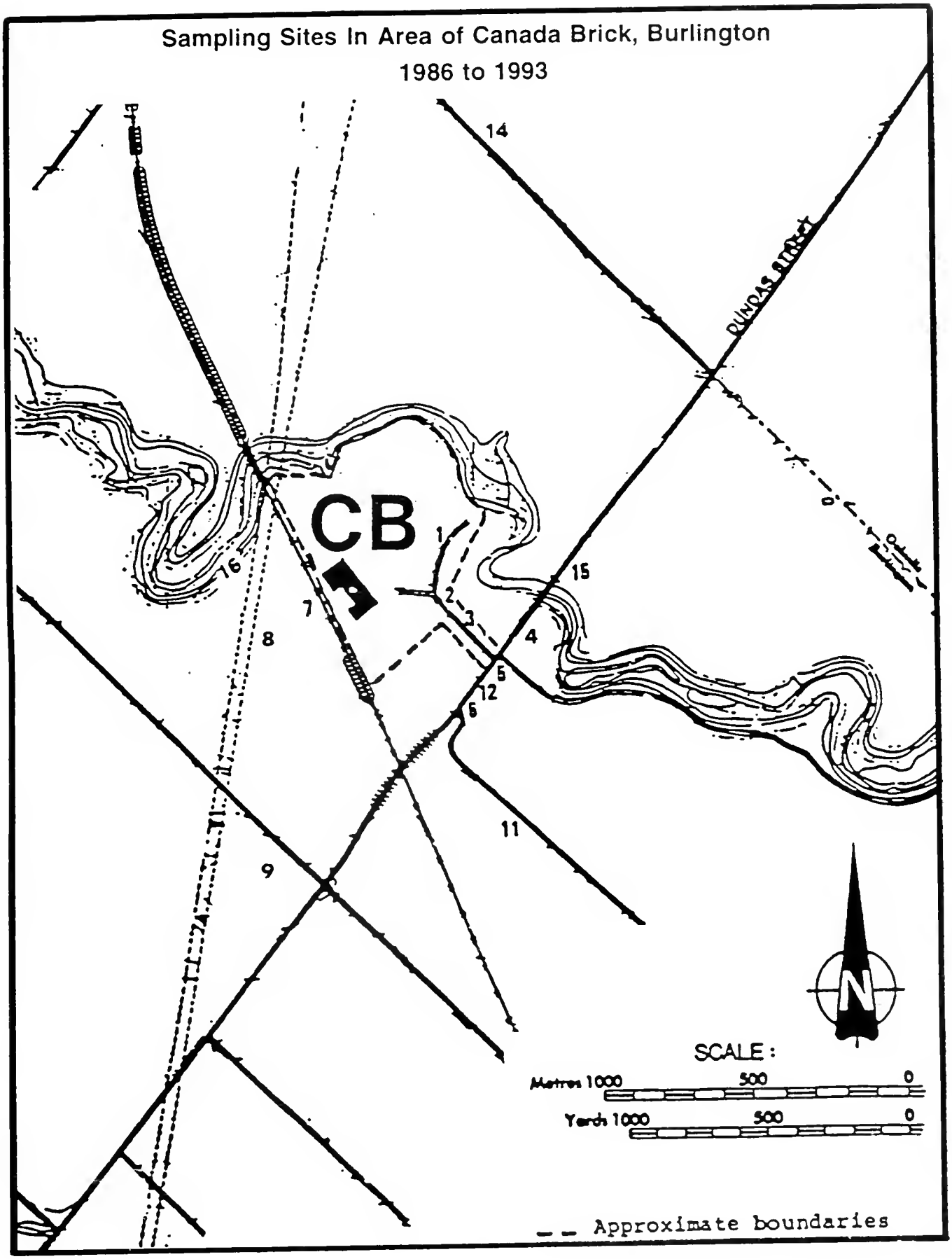
Table 2: Wind Data: Oakville Station* (1992 and 1993)		
Wind Direction	**Percentage (%) of Time Wind was Blowing from Specified Wind Direction from June through August****	
	1992	**1993**
North	2.1	2.1
North northeast	2.1	0.9
Northeast	1.5	0.8
East northeast	7.0	3.8
East	4.8	5.0
East Southeast	1.5	1.6
Southeast	4.5	6.6
South southeast	3.5	2.5
South	0.8	0.4
South southwest	0	0
Southwest	0.1	0
West southwest	0.5	0.5
West	**5.9**	**9.2**
West northwest	**8.8**	**12.5**
Northwest	10.0	8.7
North northwest	3.7	2.8
Calm Days	43.2	42.3
Missing Data	0.1	0.3

* Bronte Road / Woburn Crescent Station Number 44015
** June through to and including foliage collection date: Aug 27 1992; Aug 30 1993
Note: Shaded cells denote wind directions with greatest increase in winds in 1993

Table 3: Rainfall Data: Pearson Airport - June through August (1992 and 1993)

Amount of Rain	Number of Days with Rain / Total Rain							
	1992				1993			
	Jun.	Jul.	Aug.*	Tot.*	Jun.	Jul.	Aug.*	Tot.*
0.2 mm or more	9	13	13	34	13	10	10	33
1.0 mm or more	8	13	10	31	10	8	7	25
2.0 mm or more	4	10	10	24	8	6	5	19
10 mm or more	1	6	2	9	5	2	1	8
Total Rain (mm)	37.2	134.5	116.0	287.7	133.8	87.7	38.7	260.2
Normal (mm)**	**68.5**	**71.4**	**82.1**	**222**	**68.5**	**71.4**	**82.1**	**222**

* Through to and including date of foliage collection: Aug. 27, 1992: Aug. 30, 1993.
** Normal shown for August represents all of August.
Note: Normals were extracted from: Canadian Climate Normals (1961-1990), Ontario edition, Atmospheric Environment Service, Environment Canada.


Sampling Sites In Area of Canada Brick, Burlington
1986 to 1993
CB
QUINDAS STREET
14
15
16
1
2
3
4
5
6
7
8
9
11
12
N
SCALE :
Metres 1000
500
0
Yards 1000
500
0
Approximate boundaries

Appendix

Derivation and Significance of the MOEE Phytotoxicology "Upper Limits of Normal" Contaminant Guidelines.

The MOEE Upper Limits of Normal (ULN) contaminant guidelines represent the expected maximum concentration in surface soil, foliage (trees and shrubs), grass, moss bags, and snow from areas in Ontario not exposed to the influence of a pollution source. Urban ULN guidelines are based on samples collected from urban centres, whereas rural ULN guidelines were developed from non-urbanized areas. Samples were collected by Phytotoxicology staff using standard sampling procedures (reference: *Ontario Ministry of the Environment. 1989. Ontario Ministry of the Environment "Upper Limit of Normal" Contaminant Guidelines for Phytotoxicology Samples. Phytotoxicology Section, Air Resources Branch: Technical Support Sections NE and NW Regions, Report No. ARB-138-88-Phyto. ISBN: 0-7729-5143-8.*). Chemical analyses were conducted by the MOEE Laboratory Services Branch.

The ULN is the arithmetic mean plus three standard deviations of the suitable background data for each chemical element and parameter. This represents 99% of the sample population. This means that for every 100 samples that have not been exposed to a pollution source, 99 will fall within the ULN.

The ULNs do not represent maximum desirable or allowable limits. Rather, they are an indication that concentrations that exceed the ULN may be the result of contamination from a pollution source. Concentrations that exceed the ULNs are not necessarily toxic to plants, animals, or people. Concentrations that are below the ULNs are not known to be toxic.

ULNs are not available for all elements. This is because some elements have a very large range in the natural environment and the ULN, calculated as the mean plus three standard deviations, would be unrealistically high. Also, for some elements, insufficient background data is available to confidently calculate ULNs. The MOEE Phytotoxicology ULNs are constantly being reviewed as the background environmental data base is expanded. This will result in more ULNs being established and may amend existing ULNs.